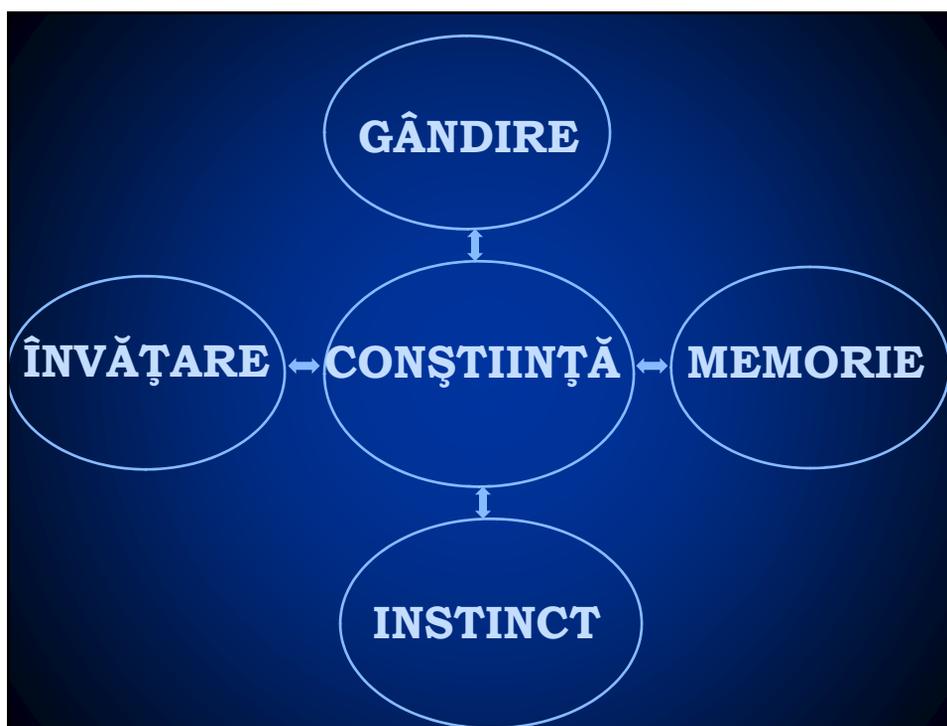


CONȘTIINȚA
CONSCIOUSNESS
CONȘTIENȚA
AWARENESS



Structura cursului

Abordare electrochimică

Abordare cuatică

Structura cursului

Abordare electrochimică

Understanding consciousness is by far the most challenging task confronting science. The truth of this assertion can best be seen in the career of Francis Crick, perhaps the most creative and influential biologist of the second half of the twentieth century. When Crick first entered biology, after World War II, two great questions were thought to be beyond the capacities of science to answer:

1. What distinguishes the living from the nonliving world?

***2.** What is the biological nature of consciousness?*

1. What distinguishes the living from the nonliving world?

*By 1953, after just two years of collaboration, he and Jim Watson had helped solve that mystery. As Watson later described in *The Double Helix*, "at lunch Francis winged into the Eagle [Pub] to tell everyone within hearing distance that*

WE HAD FOUND THE SECRET OF LIFE."

In the next two decades, Crick helped crack the genetic code: how DNA makes RNA and RNA makes protein.

2. What is the biological nature of consciousness?

In 1976, at age sixty, Crick turned to the remaining scientific mystery: the biological nature of consciousness. This he studied for the rest of his life in partnership with Christof Koch, a young computational neuroscientist. Crick brought his characteristic intelligence and optimism to bear on the question; moreover, he made consciousness a focus of the scientific community which had previously ignored it

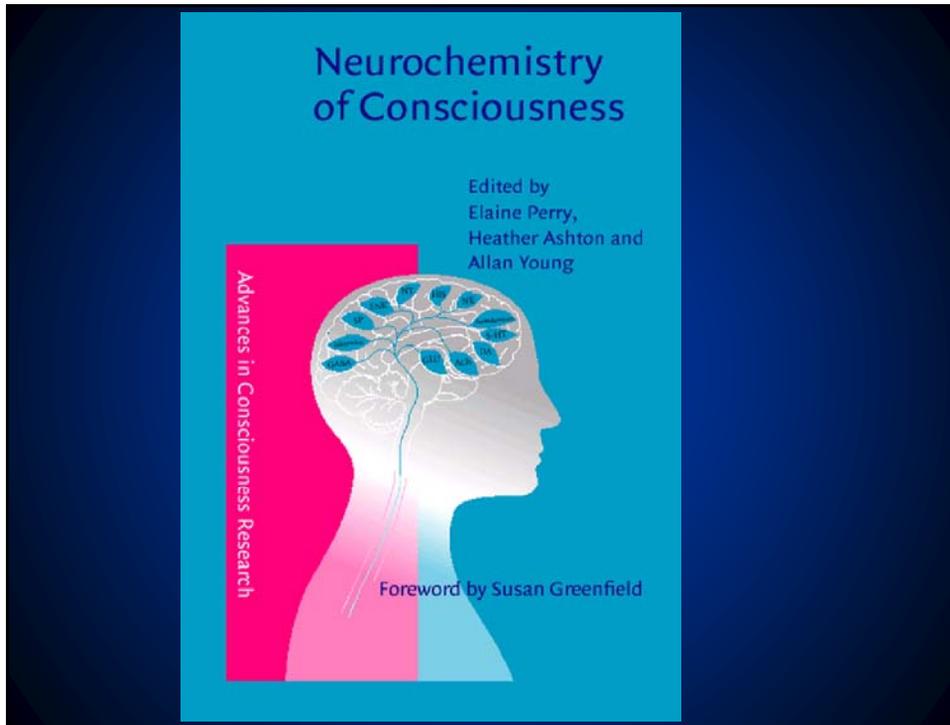
2. What is the biological nature of consciousness?

But, despite almost thirty years of continuous effort, Crick was able to budge the problem only a modest distance. Indeed, some scientists and philosophers of mind continue to find consciousness so inscrutable that they fear it can never be explained in physical terms. How can a biological system, a biological machine, they ask, feel anything? Even more doubtful, how can it think about itself?

Kandel E R. 2002.

Just over 10 years ago the British psychologist, Stuart Sutherland stated (in the Oxford Dictionary of Psychology) that consciousness was impossible to define, that its function or even why it evolved is unknown, and that nothing of any value had ever been written about it

In a recent major text, The New Cognitive Neurosciences (2000), Christof Koch and Francis Crick maintain that “precise definitions of consciousness are premature” but suggest “the most promising empirical approach is to discover the neuronal correlates of consciousness”.



Locked-In syndrome

Modularea chimică

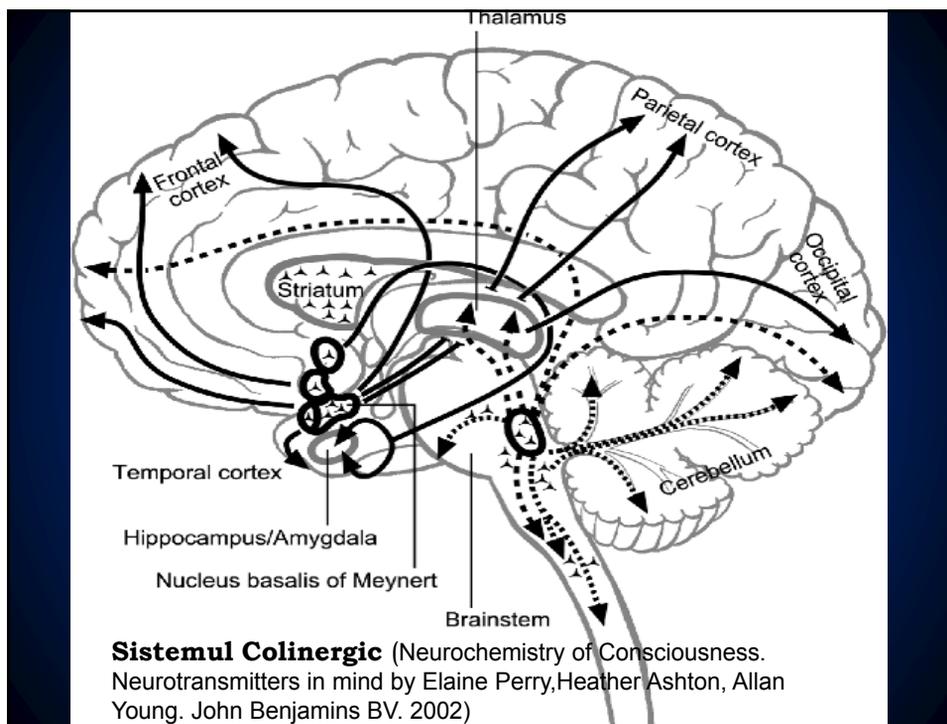
Sistemul colinergic

Acetylcholine is in evolutionary terms an extremely old molecule, being found in such primitive organisms as blue-green algae, yeast and fungi as to suggest its presence some 3 billion years ago (for review, see Wessler et al., 1999).

Many non-neuronal cells contain acetylcholine. Along with directly organizing the cytoskeleton, many non-neuronal functions of acetylcholine indirectly involve the cytoskeleton (mitosis, differentiation, locomotion, migration, cell-to-cell contact). It is likely that neuronal functions of acetylcholine were built upon this foundation of earlier roles

- According to Mesulam et al. (1995) the size of nucleus basalis cholinergic projections to the cortex indicates that “this pathway is likely to constitute the single most substantial regulatory afferent system of the cerebral cortex.”

- Based on the maintenance of cortical activation during REM, Buzsaki et al. (1988) concluded that “the ascending cholinergic system alone is capable of keeping the neocortex in its operative mode.”



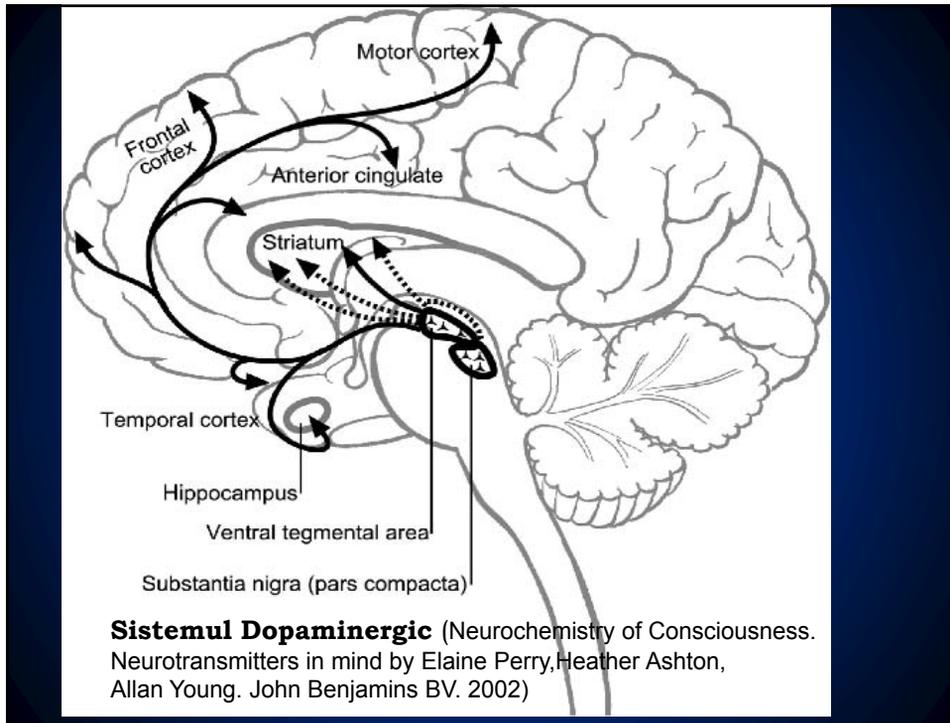
Other cholinergic pathways in the brain include a network of intrinsic neurons in the striatum, and also various nuclei in the lower brain stem which project to the cerebellum are the origins of the cranial nerves. Striatal cholinergic neurons project mainly to spiny neurons which are the principal locus for the relay of cortical information flow through the basal ganglia

In many cortical neurons acetylcholine is not directly excitatory, but enhances neuronal responses to glutamate. Reinforcing the actions of executive transmitters such as glutamate and GABA, acetylcholine could increase competition between excitatory and inhibitory states so restricting neuronal numbers depolarising at any one time to those most relevant to the immediate external or internal environment

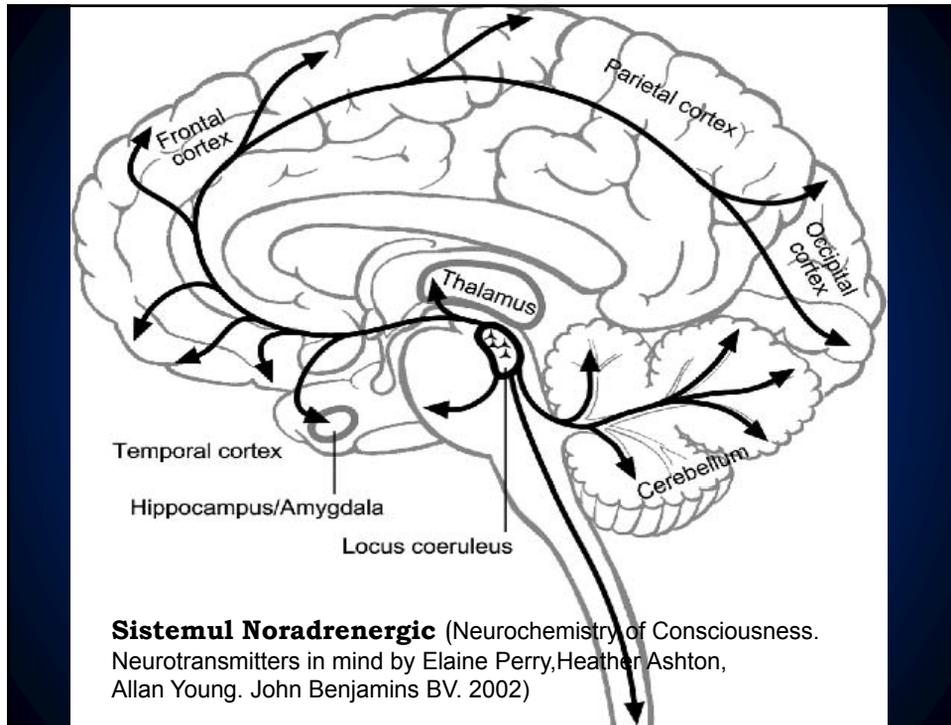
Modularea chimică

Sistemul dopaminergic

Dopamine transporters in the cortex are concentrated in cingulate and medial prefrontal regions. While cholinergic and noradrenergic systems are said to be involved in 'low level' aspects of attention (e.g. Attentional orienting), the dopaminergic system contributes to motivated behaviours and is said to be associated with more 'executive' aspects of attention such as attentional set-shifting or working memory. It has recently been suggested that dopamine rather than signalling pleasure may function to highlight significant stimuli



- *Norepinephrine or noradrenaline, and epinephrine or adrenaline are the prototypic signals mediating increased activity in response to arousal or stressful stimuli. Central noradrenergic pathways control both cerebral and sympathetic activities. Neurons which synthesise noradrenaline are restricted to the pontine and medullary tegmental regions*



Even more expansive than noradrenergic projections are those originating from the brainstem raphé nuclei which contain the indolamine transmitter serotonin or 5-HT . These neurons have highly branched fibres which innervate virtually the entire central nervous system. 9 sub-groups (B1–B9) of serotonergic neurons within the raphé have been identified.

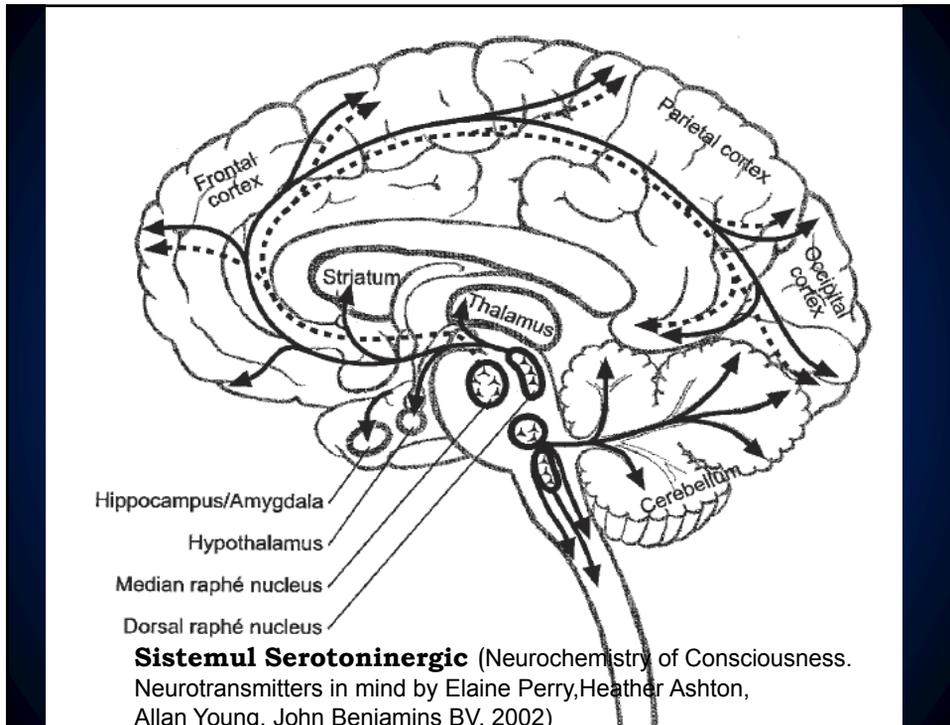
- 5-HT neurons are frequently mingled with other neuron types containing dopamine, noradrenaline, GABA and several peptides. The raphé nuclei have accordingly been described as a multiple transmitter complex. This concept is further supported by the coexistence of peptides such as substance P and TRH with serotonin

- Serotonergic dendrites and axons are often found in contact with blood vessels raising the question of whether serotonin may be particularly important in volume control neurotransmission. 5-HT is released into the ventricular csf through which it exerts a hormonal-like influence on receptors distant from the axonal terminals.

Since 5-HT is primarily an inhibitory transmitter, an integrative role in conscious awareness could involve selective suppression of neuronal activity, an essential component of neuronal network function. It has been proposed that 5-HT functions as a general inhibitor of behavioural responding.

During REM sleep, 5-HT neurons are practically silent and hallucinatory images of dreaming may relate to the loss of cortical 5-HT induced inhibition

How the 14 or more 5-HT receptor subtypes contribute to network neuromodulation is unknown.



INTEGRARE CHIMICĂ !!!

Neuropeptide

Numerous peptides have been identified in neurons throughout the brain with neurophysiological characteristics of the classical transmitters described above, but occurring at much lower concentrations

- These small peptides interact with specific receptors, but do not have rapid reuptake systems for their inactivation being instead hydrolysed by broad spectrum peptidase enzymes.

Neuropeptide action is thus longer lasting than most classical transmitters and probably, by virtue of cerebrovascular transport, much more wide ranging across different brain areas

Many neuropeptides (e.g. Somatostatin, MSH, neuropeptide Y, TRH, galanin, substance P, CCK, CRH, VIP, neurotensin) are co-localised in specific hypothalamic nuclei (Lantos et al., 1995) and are involved in the regulation of basic functions as food, water and salt intake and sexual activity.

Others, such as the endogenous opiates (endorphins, dynorphins and enkephalins) are primarily concerned with stress responses triggered by perception of pleasure or pain. It would be difficult to argue based on localisation and neurophysiology that such neuropeptides are specifically involved in the rapidly transient integration required for conscious awareness.